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AIRSPACE POLICY AND AIR TRAFFIC MANAGEMENT

UAV System Challenges

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ABSTRACT

The world of manned aviation has been the predominant aerial activity in the skies for the 20th century. The fundamental principle by which the infrastructure and institutional arrangements have been predicated is that there is a man in the loop in the air (pilots) and on the ground (air traffic controllers). With the advent of extremely capable Unmanned Aerial Vehicle (UAV) systems, this will no longer be the case and many assumptions about how aircraft are designed, developed and operated will be challenged. However, in the 21st century this will be an evolutionary process and the organisations that will take it forward are already in place today, to begin the task of providing the necessary frameworks within which UAV systems will co-exist alongside manned aircraft.

The challenges for these organisations include legislation and regulation, airspace policy, air traffic management, airworthiness, certification, communications, command and control. This lecture covers issues relating to airspace policy and air traffic management aspects.

1 INTRODUCTION

1.1 The current framework

The global framework for civil aviation derives from the Convention on International Civil Aviation (Chicago Convention) of 1944 that set the international dimension to aviation, as we perceive it today. Under the auspices of the subsequent International Civil Aviation Organisation (ICAO), views have been developed to cope with differences in aviation's regional growth and complexity.

The European dimension to the management of air traffic has involved a number of organisations. Membership of these organisations is diverse and disparate so that building consensus through any one these organisations has not build consensus at a regional level.

At a national level the International regulations, standards and recommended practices are interpreted and enshrined in legislation or through appropriate measures, this interpretation aspect, has led to national differences. A process of harmonisation in Europe is now however a driving force. There is also a similar harmonisation and convergence occurring between the collective European states and the United Sates on a number of related issues.

In the United Kingdom, which reflects the state in other countries, there is no provision made for either the certification or operation of UAVs. So as things stand today, UAVs must be restricted to danger areas unless specific exemption is given by the Civil Aviation Authority's, Safety Regulation Group. In the UK, MOD policy is to respect the primary statutory document, the Air Navigation Order No. 2 (1996), and so this state of affairs also applies to military UAVs.

The advent of Trade Associations focussing on UAV activities has led to a sharp increase in the level of debate. In the United Kingdom, the stage is now set for greater co-operation between Regulatory Authorities and Industry through the work of the Unmanned Aerial Vehicle Systems Association.

1.2 Sovereignty, legal and regulatory frameworks

key question and still the most crucial today. The focus is both on the nationality of the aircraft and the sovereignty of the airspace. It is a major defence and political issue. It drives to the heart of a country's being and hence has led many organisations, especially in Europe, to have an active role in aviation's development. Much of the sovereignty issues are historic and in Europe this has held up the development of the internal market. This is in contrast to America, where one language, and one large country has had its benefits.

A legal and regulatory framework for aviation has emerged that still adheres to a national regulatory focus but within a global and regional legal framework. This has meant the evolution of regulatory processes that are neither efficient nor globally effective.

The global framework begins with the political framework through the United Nations, and in Europe continues with the Council of Europe and the European Union. Following on from this, other organisations have emerged and evolved to work within these frameworks or to complement them, such as NATO. At the national level the seeds of self-interest always conspire to make any issue that more complicated.

The military have been more nationally driven and by a different set of rules. A pre-requisite for military superiority is uniqueness, since one always wants to have something that the opposition does not. This is counter intuitive to setting up common standards and co-operative agreements. However through such organisations such as NATO standards and co-operation have started to occur as more and more allies train and fight alongside each other. However, the increasing commercial pressure to cut costs appears a greater driver

1.3 Airspace Policy and Air Traffic Management

Airspace policy is about the political framework and the legal framework within which aviation activity occur. In the UK it is also about ensuring that all users have access to airspace to perform their operation, which is is nearly always a compromise. This then leads on to the establishment of a certification and licensing regime which are the strategic pre-requisites for any operations. Air Traffic Management operates within this framework, focussing on ensuring that aircraft movements operate safely and effectively for all concerned. Aircraft operations cover a wide range and because of this a system has evolved to segregate those with different aerial activities. This system covers military and civil operations and can be vastly different from one country to the next.

At the highest level there is the interface between the various countries and the establishment of different flight regions. This leads on to classes of airspace for different kinds of operations and the rules of the air by which pilots must comply. This paper will explore this aspect later.

1.4 The advent of the Unmanned Aerial Vehicle (UAV) System

UAVs are largely undefined and few have really given thought to any definition. In a strategic sense definitions are important. They provide the basis for understanding who should be involved in discussions and who are the stakeholders.

Many organisations may not at first sight have relevance to UAVs but that is probably because it is easy to be blinded by the notion of the man in the loop and its underlying assumptions. Many organisations exist on behalf of members such as the International Air Transport Association who look after the interests of the airline community. Since most airlines are state owned, these kind of organisations are powerful lobbying groups, which may see the UAV as a threat. However, they may be as equally significant in shaping the future processes and direction of the UAV industry and the regulatory framework.

UAVs have up till now largely been constructed and flown on a national basis and then primarily by the military. This has led them to be largely ignored by the global and regional level civil aviation organisations. At a national level the low level of activity has led to flights being individually

sanctioned by the civil or military aviation organisations that deal with certification, licensing and air traffic management.
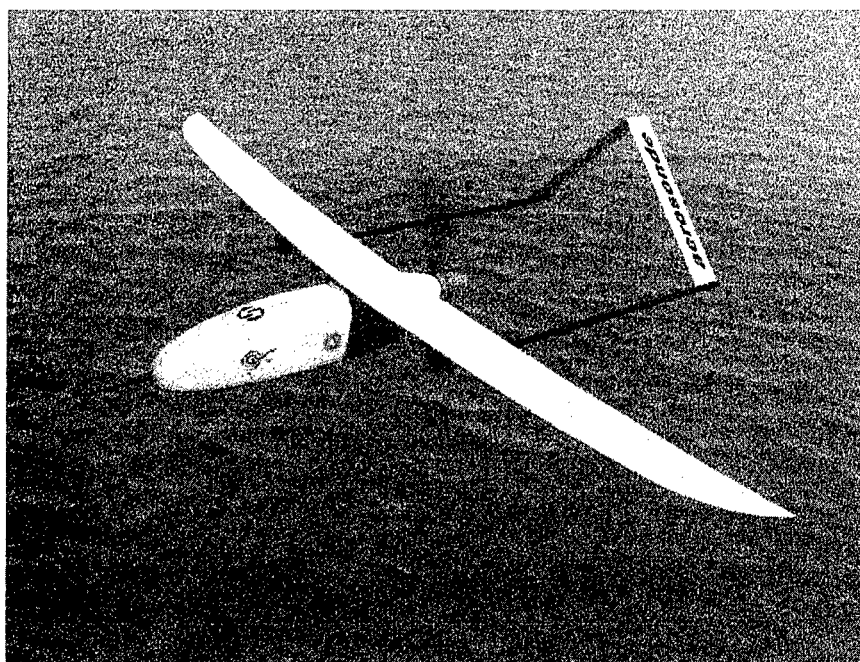

Figure 1 The Aerosonde

The flight of the Aerosonde[1] across the Atlantic was probably the first civil international UAV flight encompassing sovereignty, airspace policy and air traffic management issues. However, the aircraft was not allowed to fly in controlled airspace and the certification of the aircraft was not addressed as there was no way for this to be carried out.

From experience anything that needs to occur in a five-year timeframe in the aviation industry is tactical and only beyond this can one truly start to think of strategic directions and evolutions.

The big issue is that most people's current perception of UAVs is limited to the tasks that they have been allowed to undertake e.g. military surveillance and reconnaissance, local camera photography etc. Once it is realised that UAVs could be freight carriers and travel internationally, then it becomes apparent that many organisations should be interested in their development.

2   INDUSTRY AND THE INSTITUTIONAL BACKGROUND

2.1   The Birth of International Civil Aviation

The Second World War accelerated the technology required to fully realise an international civil aviation industry. There was also the expectation of a favourable end to the war and this led 54 states to convene in Chicago on 1 November 1944 to lay down the rules for what was to be a fast growing industry. The outcome was the Convention on International Civil Aviation or Chicago Convention (appendix B), the legal framework upon which all subsequent air transport industry development has been based.

The international organisation created as a result of the convention was the International Civil Aviation Organisation (ICAO) which came into force in 1947 with its headquarters in Montreal, Canada where they are still located today. ICAO is a specialised agency of the United Nations. It sets standards and recommended practices in 17 areas, including Air Traffic Services and Aeronautical Telecommunications. It also recognises nine geographical regions, which must be treated individually for planning air navigation facilities which include Europe and North America.

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[1] A 13 Kg, 3 metre span unmanned aircraft called Aerosonde successfully flew across the Atlantic in 26 hours landing on August 21st 1998. It was a civilian flight organised by the INSITU group who are looking to develop UAVs for meteorological observations over the ocean.

The aim of ICAO is to "*foster the safe and orderly development of international air transport service on the basis of equality of opportunity and social and economical operations.*" The key element from the Chicago Convention, that is still very relevant today, is that it makes a specific guarantee of sovereign rights in the air. The Americans had wanted an "open sky" policy to be adopted but instead the now famous six freedoms were established and the Americans had to accept that there could be no stable commercial activity without some kind of reciprocity.

The most important bi-lateral agreement was the Bermuda Agreement of 1946 between the United States of America and Great Britain. Its main feature was the formula of granting reciprocal rights to designated carriers. The capacity and frequency levels were left to the operators, subject to vague guidelines. This formed the blueprint for all bi-lateral agreements among ICAO member states.

The Convention also recognises the right of any state to insist that air services within its own territory or designated by it in bilateral air services agreements on international routes should be operated by airlines which are "*substantially owned and effectively controlled*" by its own nationals.

As the top organisation in the international aviation community , ICAO sets Standards and Recommendations (SARPs) in all areas. Most notably Annex 8 to the convention contains those SARPs related to airworthiness, Annex 10 those related to Air traffic Systems and Annex 11 covers Air Traffic Management issues.

Among ICAO's more recent significant achievements has been the development of a satellite-based system concept to meet the future communications, navigation, surveillance/air traffic management (CNS/ATM) needs of civil aviation.

In December 1944 the chief executives of 19 state owned airlines convened. The result was the birth of the International Air Transport Association (IATA). Whereas ICAO is a forum for national governments, IATA functions as the international air transport industry's link with governments and the public. It is the world parliament of the airlines and their representative in international organisations.

In both its organisation and its activity, IATA has been closely associated with ICAO. For the airlines, IATA provides machinery for finding joint solutions to problems beyond the resources of any single company. For governments, IATA helps co-ordinate international rates and fares, and to facilitate the fast and economical transport of airmail. For the public, IATA ensures high standards of efficient operation everywhere.

There is no doubt that air transport is a dynamic force in our modern world. From 1944 to 1989 the number of passengers carried rose from nine million to over one billion, a hundred-fold increase. Airfreight, which did not exist in 1944, has now become an essential component of world trade.

2.2   The Regional Dimension in Civil Aviation

The two great nations at the end of the Second World War were America and Great Britain, the latter albeit in a severely weakened state. America had by this time a thriving aviation heritage upon which to build and a burgeoning internal market, which allowed it a freedom of operation, which could not be duplicated in Europe. Europe was, and still is, a collection of many nation states constantly in flux and driven by many differing national identities.

An intergovernmental organisation set up in Europe in 1948, was the Council of Europe which includes a wider range of countries than the European Union (EU) discussed later. It is mentioned here for completeness and as a political forum should not be confused with the European Council of the EU. It is still in operation today.

Europe in recovering from economic devastation after the Second World War did not at first address its unique development problems in a collective manner. In 1955, 2 years before the birth of the European Community (EC), the European Civil Aviation Conference (ECAC) was formed. Its objective is to review generally the development of European air transport so as to promote the co-ordination, the better utilisation, and the orderly development of air transport, and to consider any special problems that may arise in this field. It is in this respect that it has extended its influence in recent years to cover Air Traffic Management issues.

Recommendations adopted by ECAC are aimed at the harmonisation of policies of its member states, usually with regard to co-operation between their airlines, charter operations, fares and rates. Currently there are 37 member states in ECAC and they are represented by their Directors General of Civil Aviation. The special problem of European air traffic congestion led in 1987 to ECAC involving the relevant Transport Ministers.

On 13th December 1960, the International Convention relative to co-operation for the Safety of Air Navigation laid the foundation for the formation of Eurocontrol in 1963. The aim of Eurocontrol is to provide a variety of air traffic services for member states at their request. Eurocontrol's functions encompass those that are not perceived as threatening to the sovereignty of individual states. This aspect makes it complimentary in many ways to ECAC, which is a political forum.

All European Airlines that run scheduled services belong to an organisation known as the Association of European Airlines (AEA). Unlike IATA that has far greater industry responsibilities, the AEA has little part in enabling change. Despite this it has been an outspoken critic of national governments' responsibilities for dealing with the airspace infrastructure problems within Europe. In particular it has criticised the European Union for not harmonising the skies over Europe.

2.3 The Regional Military dimension

Although the world of aviation is largely being shaped by civil requirements, the military still have extensive operations. Many exercises and routine operations are carried out between Nations. The most notable international organisation in dealing with military issues is the North Atlantic Treaty Organisation (NATO).

The North Atlantic Treaty was signed in Washington on 4 April 1949, creating an alliance of 12 independent nations committed to each other's defence. Four more European nations later acceded to the Treaty between 1952 and 1982.

The North Atlantic Treaty has continued to guarantee the security of its member countries ever since. Today it has been restructured to enable it to participate in the development of co-operative security structures for the whole of Europe. It has also transformed its political and military structures in order to adapt them to peacekeeping and crisis management tasks undertaken in co-operation with countries that are not members of the Alliance and with other international organisations.

NATO's North Atlantic Council established the NATO Committee of European Airspace Co-ordination (CEAC) in 1955. This filled an important gap in International co-operation since military aspects were excluded from the charter of ICAO. NATO (CEAC) is a joint Civil/Military organisation examining Airspace Planning within Western Europe.

2.4 The European Union

On 25 March 1957 the Treaty of Rome was signed by France, Germany, Italy along with the Benelux countries, Belgium, Netherlands and Luxembourg which subsequently brought the European Community of six into being on 1 January 1958. This formed what was basically a Free Trade Area and was the first step towards integration. The European Union (EU) as it is now called, consists of five main bodies, the Council of Ministers, the European Commission, The European Parliament, The European Court of Justice and the Economic and Social Committee. The main element in the Treaty of Rome expresses the need to develop a single common market.

A common transport policy document has been produced but there is along way to go in making it effective in Europe. Ministers have since turned to the frail Air Traffic Control Infrastructure and the European Commission has been active in trying to influence civil aviation's evolution. This has been resisted by many countries, arguing that there were organisations in a much better position to effect change.

2.5   The European Aviation Context

The first thing one comes to realise about how institutional arrangements operate within Europe, is that no one forum contains all the required member states to effect a change. Europe from an outsider's point of view looks fragmented and so do its institutions. Figure 2 shows the EU and the main aviation organisations in Europe. It clearly shows the different memberships and how no one forum can be looked at in isolation.

Following on from what has been said previously, there is a close link between the certification of an aircraft and the ability to fly in different airspace, in different countries. However the degree of consensus that looks possible within the JAA on airworthiness issues, is far less than could be achieve by Eurocontrol on air traffic management matters.

The consequence of this is that most countries prefer to operate at a national level as far as possible. In fact in many cases the legal frameworks are different. However the power of the EU comes to bear in that its member states are governed by the same laws, i.e. EU European Law. These gives great powers to the EU to effect change over its member states through directives and regulations.

The problem that arises is that differences build up between nations depending on whether they are members of this or that organisation. The key behind the EU and now behind the JAA and Eurocontrol, is harmonisation. This is both in terms of standards and in terms of operations.
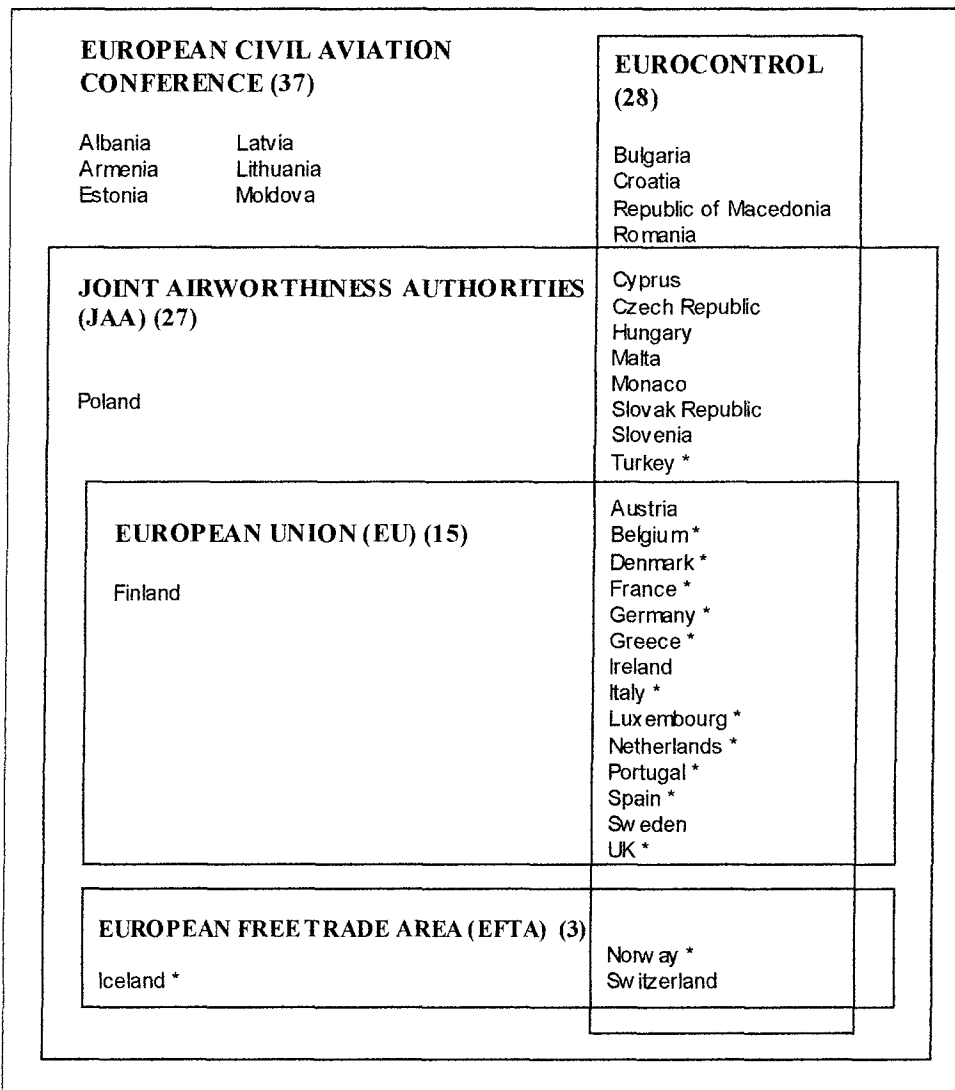
EUROPEAN CIVIL AVIATION CONFERENCE (37)	EUROCONTROL (28)
Albania Latvia Armenia Lithuania Estonia Moldova	Bulgaria Croatia Republic of Macedonia Romania
JOINT AIRWORTHINESS AUTHORITIES (JAA) (27) Poland	Cyprus Czech Republic Hungary Malta Monaco Slovak Republic Slovenia Turkey *
EUROPEAN UNION (EU) (15) Finland	Austria Belgium* Denmark* France * Germany * Greece * Ireland Italy * Luxembourg * Netherlands * Portugal* Spain * Sweden UK*
EUROPEAN FREE TRADE AREA (EFTA) (3) Iceland *	Norway * Switzerland

Figure 2 - European Institutions and their membership
(those states marked with * are also in NATO along with Canada and the United States)

NATO has also been promoting harmonisation of standards through its STANAGS, however it only has 16 member states and concentrates more on military issues.

The most successful forum for effecting change has been ECAC. It has the most number of members and because of this has taken a greater role than it was originally set up to undertake, in all aspects of aviation's evolution.

2.6 The American influence

The picture is not complete unless the American influence on the world of Aviation is taken into account. Being the biggest economy in the world, it has also developed the biggest aviation industry in the world.

The main relevant organisation is the Federal Aviation Administration (FAA) which has a similar role to the Civil Aviation Authority in the UK.

The FAA's mission, is to improve the safety and efficiency of flying. For the first time commercial space launch operations have come under FAA, and a new range of issues from safety to competitiveness will be addressed. Because the U.S. aerospace industry is active worldwide, FAA has a global perspective, expanding with the addition of its commercial space functions. Government Administration and Congress mainly direct the FAA.

FAA's major functions are to:

- Develop, operate, and maintain a safe, productive, and efficient national air traffic management system

- Ensure a national air traffic management system which is in harmony with a safe, secure, efficient worldwide system

- Regulate and encourage aerospace safety and security

- Protect the public from aircraft noise

- Assist and promote development of airports and the U.S. aerospace industry

- Promote U.S. aerospace industry vitality

The FAA has a number of bi-lateral agreements with countries such as Canada and the UK regarding the harmonisation of airworthiness standards and is active in trying to bring together the European Joint Aviation Requirements (JARs) and its own FAA Airworthiness Requirements (FARs). In ATM terms it has the largest commercial and military aviation activity and so the FAA has great influence in the world.

2.7 A National Viewpoint

As an example of a national view (figure 3), the United Kingdom sits inside this global and regional framework and has nationally based organisations capable of interpreting and administering all the various regulations and directives from all these institutions (Table 1). It is not surprising therefore that problems arise and different interpretations occur between countries

Perhaps the first thing to be understood is that it is the Governments of Member States that are members of these forums and not their agencies. So the United Kingdom National Aitr Traffic Systems Limited is not a member of Eurocontrol, it is the UK government that is the member.

The Civil Aviation Act (1982) provides the CAA with wide ranging powers to deal with all aviation matters, even the legal power to impound aircraft for the non-payment of navigation charges. The other main Statutory Instrument is The Air Navigation Order 1995 (ANO).

The ANO is amended by an Act of Parliament. If a need for an amendment should arise, the CAA develops and proposes changes to the legislation but does not have the power to actually amend the

legislation. However, the CAA has been given a discretionary power to impose requirements on the basis of being satisfied as to the competence of any applicant for a certificate or a licence.
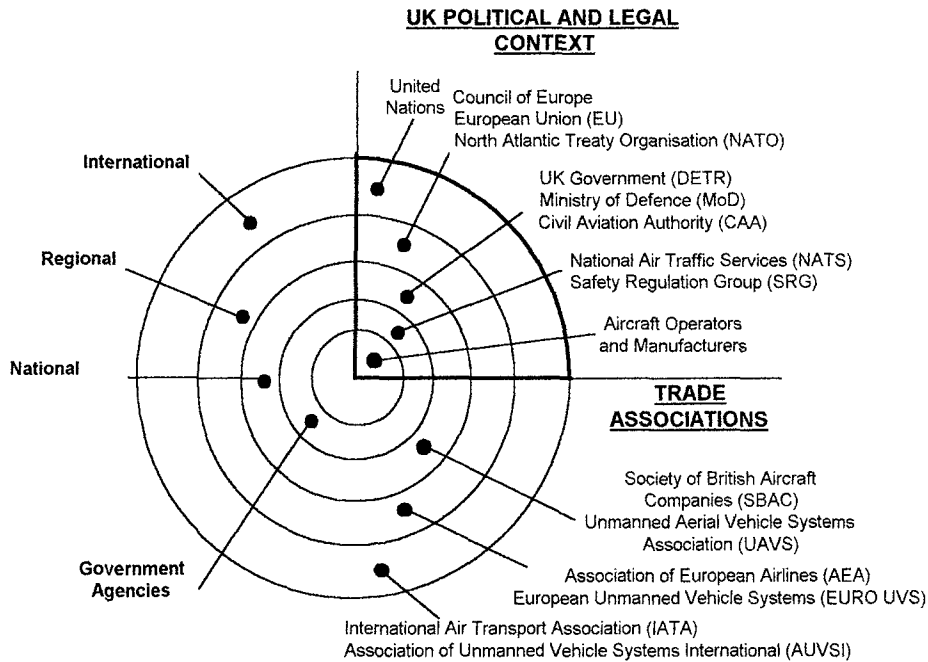
UK POLITICAL AND LEGAL CONTEXT

Figure 3 - UK Political and Legal Context for Aviation

ICAO	Standards and Recommended Practices (SARPS)
EU	Directives and regulations
JAA	Joint Airworthiness requirements (JARs)
EUROCONTROL	Air Traffic Management Standards

Table 1 – Main documents to be used and interpreted at national level

The ANO contains sections on::

- Registration and Marking of Aircraft

- Air Operators Certificate

- Airworthiness and Equipment of Aircraft

- Aircraft Crew and Licensing

- Operation of Aircraft

- Fatigue of Crew

- Documents and Records

- Movement of Aircraft

- Air Traffic Services

- Aerodromes, Aeronautical Lights and Dangerous Lights

So although the aviation industry has global and regional perspectives, national governments maintain tight control over what can actually be carried out in any particular country.

3 AIR TRAFFIC MANAGEMENT CONCEPTS AND PROGRAMMES

3.1 ICAO CNS/ATM Concept

ICAO is a driving force in Air Traffic Management (ATM) at a global level, and ATM is covered by a set of ICAO SARPS referred to in Annexes 10 and 11 of the Chicago convention. ICAO also has set up the arrangements whereby certain states are allowed to operate ATM services over some Oceanic regions. So for instance, the Shanwick Oceanic area which is basically the North Eastern Atlantic, is given over the United Kingdom to operate while the Gander FIR in the North Atlantic West region is given to Canada to operate.

However, the most significant achievement for ICAO in ATM terms is in the development of a satellite-based system concept to meet the future communications, navigation, surveillance/air traffic management (CNS/ATM) needs of civil aviation.

CNS/ATM, formerly known as the future air navigation systems (FANS) concept, is essentially the application of today's high technologies in satellites and computers, data links and advanced flight deck avionics, to cope with tomorrow's growing operational needs. It will make obsolete much of today's expensive ground-based equipment, which uses line-of-sight technology and has inherent limitations. It will also produce economies, efficiencies and greater safety. But it is not these characteristics that make it a new frontier for aviation. It will be its impact as an integrated global system with consequential changes to the way air traffic services are organised and operated.

The CNS/ATM systems concept, which has received the endorsement of ICAO Member States, is now in its implementation phase. This major task includes the development of standards, recommended practices and guidance material that will be applied well into the 21st century. From a UAV perspective this is probably the most significant enabling area in ATM.

3.2 European Air Traffic Management

The European Civil Aviation Conference (ECAC) is the body responsible for the full range of civil aviation matters in Europe in the family of United Nations organisations. It has a particularly close relations with ICAO which also has a regional office in Paris, in the same building as ECAC. ECAC brings together the top officials dealing with international aspects of aviation from each of its member states. There are 37 European member countries of ECAC which puts ECAC in a unique position.

Back in 1987 ECAC took the decision to take a major development interest in air traffic control matters because at that time the escalating scale of delays was getting worse and becoming a subject of major political attention across Europe. It appeared that while there were many ATC projects, nobody was co-ordinating it, politically. Eurocontrol was only co-ordinating a relative small number of European countries and could only do a certain amount. The ICAO regional office in Paris was developing new systems for the next century related to the Future Air Navigation System (FANS) that was being developed on a global basis with a European focus in what is termed the Future European Air Traffic System (FEATS). ICAO was not focused on the immediate to medium term growing air traffic problem within Europe and National administrations were making their own improvements but no one was communicating effectively with each other.

There was a co-ordination role required and ECAC decided to take this on. That has meant working not only with each of the other national Air Traffic Control (ATC) administrations but with a lot of other organisations that are involved in ATC to a greater or lesser degree. ECAC has no particular expertise of its own in air traffic control. It is a very small organisation in terms of numbers of staff. It was trying to bring together all the available resources, national resources and all the other bodies, under one common political hat rather than these resources being dissipated.

On one side ECAC has to work closely with ICAO, the Commission of the European Communities in Brussels, and Eurocontrol. It also has to work with the CEAC , the NATO body that concerns itself with the NATO side of the civil / military interface in air traffic control. On the other side ECAC has contact with the airlines, IATA and the AEA. All of these bodies were brought into the team in order to move

forward. The reason that ECAC could succeed where other organisations might fail was that it had the largest membership of any organisation in Europe, 22 in 1987 that has increased to 37 in March 1998.

The complexity of organisational memberships in Europe has already been mentioned, however the most dominant member states are France, Germany and the UK. The result of these complex relationships is that compromises are difficult to achieve because of conflicting interests but tend to be more binding when attained.

ECAC has in the past addressed air transport liberalisation, environmental, noise and jet engine emission types of issues. However in 1988 it held its first meetings on ATC issues. The success that ECAC has had in stimulating initiatives to tackle ATC issues has been fortuitous for the EU. Whilst the small membership of the EU could afford minimal cohesion for the ATC problems, its continuing economic influence compliments ECAC. In recognition of this ECAC is now undertaking less work within its economic committees. ECAC has a policy to co-operate with the EU, since the EU has legislative and financial abilities that ECAC does not have.

ECAC is also moving away from dealing with the majority of technical matters and concentrating on their policy implications. This will see it dealing less directly with ATC problems in Europe in the future. One area that it will concentrate on is those issues relating to environmental policy such as engine emissions. The EU on the other hand is moving towards having a greater involvement.

3.3 The ECAC Initiatives

The ECAC initiatives, to tackle air traffic capacity problems, can be viewed as occurring in three stages (table 2). The first was to get the best out of existing systems, the second was to improve en-route capabilities and the third to improve the airport air traffic system.

The first aim was to get a more orderly approach to the management of traffic in those busiest areas combined with what's called the European Co-ordination Team (ECT). A fire-fighting team of people from national administrations with air traffic expertise from all round Europe, directed by Eurocontrol, who in broad terms can at a particular air traffic control centre brainstorm on how to fix problems. They were able to target in on places where there are problems that a broader expertise can help with.

Work	Date adopted	Associated Programmes
European Co-ordination Team & Flow Management	Initiated 1988	CMFU Central Flow Management Unit
En Route Air Traffic System Strategy	Adopted 24th April 1990	EATCHIP European Air Traffic Control Harmonisation & Integration Project
Airport Air Traffic System Strategy	Adopted 17th March 1992	APATSI Aiport Air traffic Systems Interface

Table 2 - ECAC Initiatives

Work towards a Central Flow Management Unit (CFMU) was initiated, under the control of Eurocontrol. Flow control is effected when the number of aircraft in any particular airspace sector becomes greater than the capacity of that sector. There is a knock-on effect to other sectors with the result that aircraft waiting on the ground at Heathrow may be waiting for airspace to be free in Greece, a truly European problem. The CFMU has now centralised all the separate flow management units within Europe, so that flow control is now more effective and the best use is made of the available airspace.

The CFMU is only a crisis tool. It is required for the peaks in air traffic demand so ECAC next set about looking at the strategic ATC issues. The first issue here was the fragmented upper airspace and its division along national boundaries. Although the issue of sovereignty and Article 1 of the Chicago Convention could not be tackled, making sure that adjacent Air Traffic Control Centres could communicate effectively and seamlessly as far as the airspace user was concerned, could be tackled. The

inability of even the best equipment in individual states to communicate freely with equipment in other states because none of it was designed for that purpose, led in part to the European Air Traffic Control Harmonisation and Integration Project (EATCHIP) project managed by Eurocontrol.

On the 13th March 1992, the ECAC ministers met in London to agree a new strategy for airports. The overall objective is to improve the potential throughput of European airports and their surrounding airspace while maintaining safety and respecting the environment.

3.4   EATCHIP Flexible Use of Airspace

The EATCHIP project put forward the concept of the flexible use of airspace. This states that airspace should no longer be designated as either purely civil or military airspace, but rather considered as one continuum and allocated according to user requirements. Any airspace segregation should be temporary, based on real-time usage within a specific time period.

It puts forward three levels of management as in Table 3. There is a sub-group called the Flexible Use of Airspace Subgroup, which has discussed the operation of UAVs and it is this group that will probably be the European focus for further work, which is supported by NATO (CEAC).

Level	Aim
1 Strategic	Establishment of pre-determined airspace structures
2 Pre-tactical	Day-to-day allocation of airspace according to user requirements
3 Tactical	Real-time use of airspace allowing a safe Operational Air Traffic/General Air Traffic separation

Table 3 - Flexible Airspace Management Levels

It is important to remember that the role of Eurocontrol regarding EATCHIP is to manage the Programme. The States, as providers of Europe's Air Traffic Management infrastructure, are responsible for the implementation of harmonised measures and the operation of integrated Air Traffic Control systems. The problems that arise is that each State implements at a different speed and in some cases at a different level.

3.5   Eurocontrol ATM work and the European Commission

Eurocontrol now has greater organisational and co-ordinating capabilities than it did in the early 1990s as it moves forward. It has also started a major consolidation of its different programmes under the umbrella strategy called ATM 2000+. Eurocontrol is also progressing the ICAO CNS/ATM strategy.

A paper, produced by the European Transport Commissioner, Neil Kinnock, and entitled, "Freeing Europe's Airspace", is part of a continuing story, in the European Commission's quest for greater powers over European Air Traffic Management.

The main theme of the paper is the call for Eurocontrol to be made into a powerful regulatory authority. This centralist approach is not new since in August 1989, the Association of European Airlines (AEA) put forward a radical idea that was backed by the European Commission of privatising Europe's air traffic control centres into a single pan-European holding company with pan European responsibility. Everyone else opposed this.

The paper suggests that the shortcomings in Europe for ATM are :-

- a fragmented overall picture

- lack of decision-making mechanisms

- lack of decision making aids

- inefficient use of available resource

- lack of means of following up decisions

- lack of tools for implementation and support

- inadequate cost control

In answer to these, the paper puts forward the need to bring together all the elements necessary to develop a comprehensive European ATM policy, effective decision-making processes based on majority voting, stronger support for decision makers, encourage managerial responsibility of ATM providers and stimulate their cost-consciousness plus a central authority.

So far, the paper has been rejected and it remains to be seen if the European Union will continue with this particular line.

3.6   NATO CEAC and NAFAG

Since 1991 NATO members and other European countries have held meetings on the civil/military co-ordination of air traffic management periodically, with high-level participation.   In May 1992, the Central and East European and Central Asian states, which are members of the North Atlantic Co-operation Council (NACC), took part in a seminar on this issue, together with representatives from NATO countries, as well as the NATO Military Authorities and five international organisations with responsibilities in this field.

From November 1992, co-operation Partners were invited to take part in plenary sessions of the CEAC addressing the civil/military dimension of the integration of Central and Eastern Europe in Western European air traffic management strategies.   Regular plenary and working level meetings now constitute part of the co-operation activities related to air traffic management foreseen in the NACC Work Plan.

Early in 1994 European neutral countries were invited to participate in CEAC activities, thereby establishing the committee as a unique forum for co-ordination between civil and military users of the entire continental European airspace, as acknowledged by the European Civil Aviation Conference. The Partnership for Peace initiative agreed by NATO's Heads of State and Government in January 1994 is further increasing concrete co-operation in this area, notably with regard to co-ordination of air exercises.

In 1992 NATO Naval Armaments Group (Project Group 35) recommended that an ad hoc working group be established to draft advisory guidelines for the air traffic management of UAV operations outside prohibited, danger or restricted areas.   The aim of this working group is to provide advisory guidelines for UAV operations which individual nations can use as a framework for developing their own regulations and procedures if and when they decide that such operations are practicable.

A document was produced in December 1997, outlining guidelines for their operation, design specification, maintenance and training of human resources.   Interestingly the definition for a UAV in the guidelines is " An unmanned recoverable aircraft, which is remotely and fully controlled by means of a pilot in command".

NATO has several groups within it but one that is of particular interest is the Air Force Armaments Group (NAFAG).   This has two sub-groups that have special interest in UAVs.   NAFAG Air Group 1 addresses airborne vehicles (manned and unmanned) and weapons interoperability seeking co-operation in research, development and production.

The Special Working Group on "Future Less-Manned Aerospace Operations" whose mission is to explore the potential for less manned aerospace operations.   It is assessing the possible use of unmanned systems to perform military roles and functions for the complete scope of aerospace mission areas and to identify potential impacts on national and NATO forces,.

With CEAC, NATO Naval Armaments Group and NAFAG all with UAV interests, and NATO's role in the EATCHIP flexible use of airspace sub group, there will undoubtedly be developments in the near future in this area.

3.7   The FAA Free Flight Concept

The dream of being able to fly wherever you want has moved a step closer with the concept of free flight. This has great relevance for future UAV operations. An RTCA Select Committee has come up with the following definition:

"A safe and efficient flight operating capability under instrument flight rules (IFR) in which the operators have the freedom to select their path and speed in real time. Air traffic restrictions are only imposed to ensure separation, to preclude exceeding airport capacity, to prevent unauthorised flights through special use airspace, and to ensure safety of flight. Restrictions are limited in extent and duration to correct the identified problem. Any activity which removes restrictions represents a move towards free flight."

It is envisaged that to make free flight work effectively a much greater degree of computer assistance will be required by controllers. This will inevitably continue the trend from "man in the loop" to "computer in the loop". The meaning here is that where at present the deciding factor is a human decision making process, the trend will be towards a computer decision making process as the complexity of aircraft intention and interaction goes beyond the intellectual, spatial, computational and temporal capability of the human controller.

There are differences in how the FAA and Europe view Free Flight which basically stem from the better ground infrastructure within Europe and some of the densest airspace. The consequence of this is that the USA are keen on much shorter timescales in moving forward to free flight. According to Eurocontrol, things that come under the free flight banner in the US are what Europe is doing with the EATMS (European Air Traffic Management System) concept.

On March 15 1996, the FAA endorsed an RTCA task force report into Free Flight and in accepting the report stated that 13 out of 37 near term recommendations would be actioned in the timeframes set out by the report. The remaining 24 would be carried forward with a redirection of FAA resource and greater participation from the user community as appropriate.

The acceptance of such a move towards a new concept in the US means that the differences between the US and Europe on the way forward could be diverging. In Europe the large investment in ground based infrastructure; navigation aids, radar and ground communications, tends to influence strategy formulation and decision making processes.

The most striking thing in the RTCA recommendations is that greater use of Satellite voice and data communications, plus VHF and HF datalinks is envisaged, but nowhere does the word radar appear. Phrases like GPS instrument approach procedures, GPS based route structure and GPS altimetry, all point to a greater dependence on what is best described as the Space segment, which will augment the ground and air segments in use today.

The recommendations point to a number of developments that could significantly alter the role of air traffic control providers. Free Flight suffers from various levels of uncertainty such as short-term knowledge of intent, no directional altitudes (i.e. flying at certain heights when on certain headings) and cruise/climb without specific clearance. In this context, predicting sector density becomes an issue. So rather than talking of a sectors capacity one talks about what if N aircraft are in a sector at the same time, each with the uncertainties listed above. This leads on to procedures about the separation of responsibilities between pilots and controllers under different traffic densities and procedures for handing over responsibility.

One way forward is to transfer to the cockpit a greater understanding of what is around it, appropriately put as, "greater situational awareness". This is probably essential when the sectors themselves may be deployed dynamically as a means to facilitate free flight operations. For UAVs this presents difficulties as there is no man in the cockpit.

4   AIR TRAFFIC MANAGEMENT OPERATIONS

The prime motivation behind any form of air traffic control is safety. Controllers must therefore keep the aircraft they handle safely separated using internationally-agreed standards. This is achieved by allocating different heights to aircraft or by arranging certain minimum horizontal distances between them. These distances vary according to circumstances, but aircraft flying along the airways under radar surveillance, for example, are kept five nautical miles apart horizontally or at least 1,000 feet vertically.

Figure 4 Aircraft Separation Standards

Within the airspace, a network of corridors has been established. These corridors, or airways, are usually ten miles wide and reach up to a height of 24,000 feet from a base of between 5,000 and 7,000 feet. They mainly link busy areas of airspace known as terminal control areas which are normally above major airports. At a lower level are the control zones which are established around each airport. The area above 24,500 feet is known as upper airspace. All these areas are designated "controlled airspace" and aircraft fly in them under the supervision of air traffic controllers. Pilots are required to file a flight plan for each journey containing details such as destination, route, timing and height.

Within controlled airspace, pilots must follow controllers' instructions; outside controlled airspace they take full responsibility for their own safety although they can ask for assistance. In fact, military controllers, who work closely with their civilian colleagues to provide a fully integrated service to all users, offer an air traffic service to aircraft in uncontrolled airspace. Military personnel also provide services to aircraft crossing airways and for those flying above 24,500 feet. A priority task for them is aiding aircraft in distress.

Aircraft in the initial or final stages of their journey are managed by controllers at the airport itself. When aircraft join the airways system, responsibility for handling them passes to colleagues working at the appropriate area control centre. A flight through their airspace could pass through several "sectors" of airspace, each managed by a different team of controllers.

Controlled Airspace is as the name suggests, subject to stringent rules that cover a number of aspects. To fly in controlled airspace the aircraft must be suitably equipped, the crew suitably qualified and the operation of the aircraft must be flown in a manner which complies with the Air Pilot.

In controlled airspace an aircraft must usually carry a radio, a transponder for secondary surveillance by radar, and suitable navigational aids. The aircraft must file a flight plan as depicted in figure 8, which is fed into the ATM system. Flight plans can be filed up to six months in advance as most scheduled airlines do. Provided the necessary changes are made, UAVs on pre-planned flights should not find a difficulty with adhering to this regime.
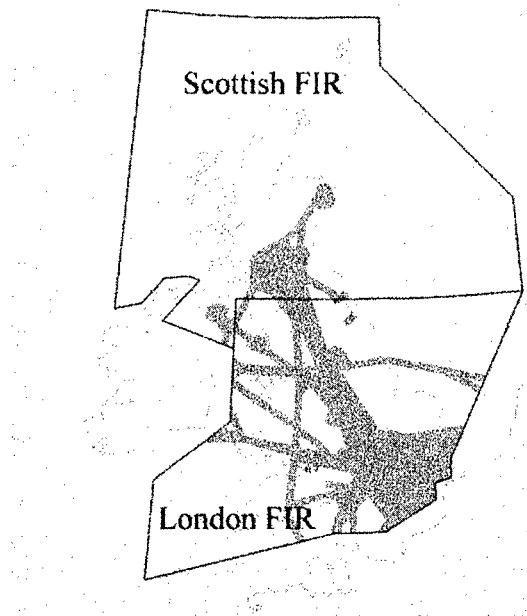
Figure 5 - UK Sovereign Airspace

Aircraft that fly in uncontrolled airspace are not subject to the same rules. They operate generally on the "See and avoid" principle. For manned aircraft this is done by the pilot, for UAVs, there is some difficulty in understanding how this could be done. Much of the difficulty that lies ahead will be focussed on the safety to third parties, in the air and on the ground, in the event of a failure of a UAV. The whole process will be a confidence building exercise based upon the responsible members of the UAV community as it develops. The military provide a number of services in uncontrolled airspace such as the Lower Airspace Radar Service.

Figure 6 Flight Plan

The control of an aircraft from take-off, through its en-route phase to landing is depicted in figure 9. The number of different scenarios that must be catered for in any ATM environment appears limitless as different aircraft operations are accommodated.
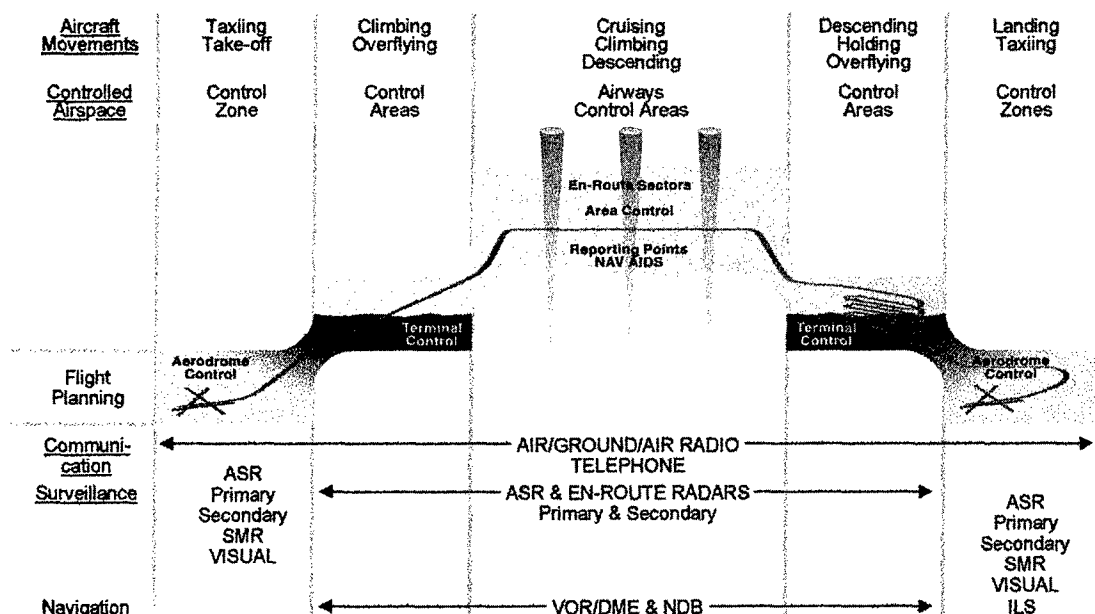
Figure 7 Typical Flight Profile

The picture is somewhat more complicated than this, since figure 9 does not illustrate the different types of aircraft and the different types of operations. To ensure some uniformity around the world, ICAO has set standard designations for the different types of airspace. Class A airspace is that used mainly by commercial traffic such as the major airlines and tends to be airways. The designations both determine the aircraft fit and the flight profiles that are to be expected.

For the UAV the main aspect to be realised is that the whole of the Airspace structure and the Air Traffic Management environment, has been developed for manned aircraft. All the rules have been written around the assumption that there is both a man in the cockpit and a man on the ground in terms of an air traffic controller, or that there are two pilots trying to avoid each other in the "See and avoid" principle.

5   CURRENT POSITION AND IMPLICATIONS FOR UAVs

5.1   The Current UK Position

There is no International or European position on UAVs. The following position on establishing requirements for UAVs in the United Kingdom is based on a letter written by the Civil Aviation Authority's legal department, a workshop held in London at the RAF Club in June 1998 and discussions with various government departments. Much of this will be similar to other national situations and serves to highkight the main issues.

The Air Navigation (No 2) Order 1995 contains a number of provisions for the regulation of aircraft. The main requirements are that any aircraft must be airworthy, which must in the case of an aircraft registered in the United Kingdom be evidenced by a certificate of airworthiness or a permit to fly issued by CAA. The aircraft must carry an appropriate number of licensed flight crew. In the case of public transport operations, the operator must hold an Air Operator's Certificate. When flying, the aircraft must comply with the Rules of the Air.

From the outset there is little understanding given to the needs of UAV flight operations. The Order does however include exceptions for small aircraft. A small aircraft is defined in the Order as any unmanned aircraft weighing not more than 20 kg. In this case, none of the above main requirements apply and a set of conditions are included at Article 76A of the Order subject to which small aircraft

may be flown without complying with airworthiness or flight crew licensing requirements, or with the Rules of the Air.

The rules for "small aircraft" have been principally developed for the purposes of regulating recreational model aircraft flying. The conditions include a prohibition on flight in controlled airspace or within an aerodrome traffic zone, unless in either case the permission of the air traffic control unit has been obtained, a normal maximum height of 400 ft above the surface and a prohibition on flight for the purposes of aerial work (commercial work) without the specific permission of CAA.

5.2   The Safety of UAVs

In order to be satisfied that UAVs may be safely operated, the CAA state that the following issues need to be considered:

- The airworthiness of the aircraft

- Safety in the air

- Maintenance

- Pilot" qualifications

Airworthiness Requirements: To qualify for a certificate of airworthiness the aircraft must be of a type that has been granted a type certificate. This requires the design to be shown to comply with the appropriate design airworthiness code and the organisation responsible for the design and the manufacture to have appropriate CAA approval. The organisations designing and building an aeroplane have to be suitably approved and the design has to be shown to comply with a set of requirements. Permits to fly may be issued without these requirements having been satisfied and it can allow some less onerous design requirements e.g. home built aircraft, microlights. Permit aircraft are not normally allowed to be used for commercial purposes.

Safety in the Air: There are three aspects to this:

- how to integrate UAVs with other traffic when flying within airspace subject to air traffic control;

- how to reconcile the unmanned nature of the vehicle with the principle of see and be seen on which collision avoidance is based outside controlled airspace and which is reflected in Rule 17 of the Rules of the Air;

- how to comply with the low flying Rules when the basic Rules (not closer than 500 ft to any person, vessel, vehicle or structure and not below 1500 ft over a congested area) require the "pilot" to have knowledge of the terrain over which the UAV is flying.

Pilot Qualifications: To achieve the same sort of safety of a manned aircraft some requirements have to be established for qualification of persons piloting the UAV.

Operational Control: Flight Manuals may be required containing all the necessary limitations and operating procedures.

5.3   Exemptions

A UAV which weighs more than 20 kg is not a "small aircraft" for the purposes of the ANO so that all the requirements referred to above (certificate of airworthiness or permit to fly, licensed flight crew, Rules of the Air) must be complied with. In practice of course a UAV cannot comply with these requirements so that the only way such a large UAV may fly is if CAA is prepared to issue an exemption under Article 116 of the ANO. If it is desired to operate a UAV that weighs less than 20 kg outside the restrictions contained in Article 76A, an exemption is also required. The possibility of exemptions does not however offer any real assistance. In order to be satisfied on the question of equivalent safety so as to be able to grant an exemption, many of the fundamental problems would need to be solved.

5.4 FAA Approach

FAA issues special authorisations for civil operations of unpiloted vehicles and the conditions appear similar to the ones used by the CAA. They are on a one-off basis. Some machines are flying beyond the direct view of the operator subject to two criteria. If outside controlled airspace, FAA require the use of a chase plane. If inside controlled airspace above 18,000 ft, operation of UAVs is permitted without a chase plane and out of direct line of sight providing the vehicle is fitted with a transponder which the ATC controller can interrogate and a global positioning system and the RPV controller is in communication with ATC.

The FAA ARAC UAV Working Group has published advisory circulars. These deal with the vehicle design, operational aspects, maintenance and the training of the operator/pilot.

5.5 Military position

Current UK Policy is that military UAVs are confined to Danger Areas (Reserved Airspace). If the MOD really wanted to operate UAVs outside of danger Areas within the UK without complying with the ANO or Rules of the Air it could as the following extracts from the ANO show:

- ANO Article 115 (3) - 'nothing in this Order shall apply to or in relation to any military aircraft

- ANO Article 118 - 'Military aircraft' include the naval , military or air force aircraft of any country and

    a) any aircraft being constructed for the naval, military or air force of any country under a contract entered into by the Secretary of State; and

    b) any aircraft in respect of which there is in force a certificate issued by the secretary of State that the aircraft is to be treated for the purposes of this Order as a military aircraft.

- ANO Article 74(3) (c) - It shall be lawful for the Rules of the Air to be departed from to the extent necessary: ...for complying with Military Flying Regulations (Joint Service Publication J318) or Flying Orders to Contractors (Aviation Publication 67) issued by the Secretary of State.....

At present there does not appear to be any move by the military to change its policy despite the provisions made in the ANO.

5.6 Some further implication for UAVs

Once it is recognised that there is really no well defined framework within which UAVs can operate effectively, the question arises as to what must be put forward to regulatory Authorities to enable them to start changing the legislation. The following are suggested headings

- Definition of a UAV

- Types of UAV

- Types of Operations for UAVs

- Ownership of a UAVs

- Airworthiness of UAVs

- Air Traffic Management of UAVs

The most obvious problem that UAVs face at the outset is the definition of what a UAV is. The fact that there is no one on board means that even filing a flight plan has its difficulties as programmes that verify such plans may require the "person on board" box to have a figure in it. Once a definition is set and is recognised fully, then existing systems can start to be modified to make allowances for the differences.

UAVs come in many sizes and capabilities and will continue to do so. A UAV with a Trans-Atlantic capability that weighs only 13Kg cannot be expected to be treated as a commercial airliner.

Equipment standards for UAVs could become prohibitive if flexibility and understanding are not employed. In operational terms, the use of ICAO airspace designations are based on the assumption of manned aircraft being those that frequented controlled airspace. However, UAVs are probably best served by being controlled in such an environment.

The operator of a civil aircraft usually determines its country of origin. However, the concept of a UAV airline which runs UAV flights in many areas of the world, could put a completely different view on ownership. This type of issue is one of international law and the accepted view that prevails.

Solutions to the above areas are almost a pre-requisite before one can discuss airworthiness and Air Traffic Management issues.

Up until now aviation has separated the concerns of airspace management and airworthiness. For a UAV it is system worthiness that is the crucial issue. The systems in both the static sense, i.e. the ability of air, ground and space components to carry out their function and the dynamic sense, the operation of the total system in real-time against some defined criteria.

There are many issues that arise, most notably the radical shift of direct control. This occurs either by transferring control to a ground controller or to the UAVs software. The "man-in-the -loop" moves from the air to the ground and even into the software development process itself.

From an international perspective it is unlikely that there will be major moves forward in airworthiness or ATM terms due to the many organisations that must come together and understand the various issues. From a European perspective, the situation is not much better however there may be hope at the national level.

6 CONCLUSIONS

6.1 Institutional Framework

The International and European institutional framework for aviation is in a process of constant change. The main international organisation, ICAO, continues to be the top level organisation from which Standards and Recommended practices are disseminated however it is in their interpretation that major problems arise.

At the European level there are numerous organisations each with a different emphasis and historical purpose. Any progress at the UK national level would assist the formulation of positions at a Regional and International level, providing a common set of principles can emerge.

At the outset it must be recognised that there is already a current manned environment based on a set of current concepts which contain the wisdom of decades of development. Any future UAV requirement must be viewed in the context of this environment. There is also an underlying set of assumptions and beliefs that this environment has been built upon, the most notable of which is the concept of the "man-in-the-loop".

The whole international, European and National basis for air transport, air vehicle certification and Air Traffic Management is far from being a seamless, integrated and cohesive area. It is the product of many countries, many organisations and many aviation group interests, constantly seeking to move things in the direction each sees as the best way forward.

The evolution of aviation in the world will continue this way for many years to come and so it is important to maintain a view on the current and possible future impact of all the different organisational influences.

Unmanned Aerial Vehicles or UAVs, have been developed largely in a regulatory vacuum, whether viewed at an international, regional or national level. No regulations have directly addressed their unique capabilities and it has been left to national regulatory authorities to interpret as best they can existing regulations, originally develop for the manned aviation world.

6.2 The future process

There is always risk associated with human endeavour and until operational requirements and operational concepts are defined, the analysis of risk will not be possible. The main process that is required for UAVs today is a risk reduction process, one that enables manufacturers and operators to work towards providing adequate evidence of a safe system.

The Unmanned Aerial Vehicle Systems Association formed in November 1998, now provides the UAV industry in the UK, with a focal point and a means to liaise, lobby and defend UAV interests on a national level.

The main aim must be to present the UAV industry as a competent and responsible community both from a military and civil perspective.

APPENDIX A RELEVANT AVIATION ORGANISATIONS AND COMMITTEES

International Organisations

IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
ITU	International Telecommunications Union
NATO	North Atlantic Treaty Organisation
	Committee for European Airspace Co-ordination (CEAC)
	NATO - Ad Hoc Working Group (AHWG) on UAVs
	NATO - Air Force Armaments Group (NAFAG)
	NATO - Army Armaments Group (NAAG)
	NATO - Industrial Advisory Group,Project Group 53 NIAG PG53
	NATO - Naval Armaments Group, Project Group 35 (NNAG PG35)

European Organisations

AECMA	Association Européen des Constructeurs de Matériel Aerospatial
ECAC	European Civil Aviation Conference
EU	European Union
EUROCAE	European Organisation for Civil Aviation Equipment
EUROCONTROL (Organisation for the Safety of Air Navigation)	
	Flexible Use of Airspace Committee
JAA	Joint Airworthiness Authorities

American Organisations

FAA	Federal Aviation Administration
RTCA Inc.	(Radio Technical Commission for Aeronautics) Inc.

UK Organisations

CAA	Civil Aviation Authority
DAP	Directorate of Airspace Policy
	UK UAV Steering Group
DETR	Department of Environment, Transport and Regions
	Air Accidents Investigation Branch (AAIB)
DTI	Department of Trade and Industry
MOD	Ministry of Defence
	Joint Airworthiness Committee 9 - Sub-Committee No 31 (UAVSSC)
	Military Air Traffic Organisation (MATO)
	Tri-Service UAV Steering Committee (TUSC)
NATS	National Air Traffic Services Limited
SRG	Safety Regulation Group

UAV Specific Organisations

AUVSI	Association of Unmanned Vehicle Systems International
EURO UVS	European Unmanned Vehicle Systems Association
UAVS	Unmanned Aerial Vehicle Systems Association

APPENDIX B   CHICAGO CONVENTION

Significant articles from the Convention on International Civil Aviation (Chicago, 1944)

PREAMBLE

WHEREAS the future development of international civil aviation can greatly help to create and preserve friendship and understanding among the nations and peoples of the world, yet its abuse can become a threat to the general security; and

WHEREAS it is desirable to avoid friction and to promote that co-operation between nations and peoples upon which the peace of the world depends;

THEREFORE, the undersigned governments having agreed on certain principles and arrangements in order that international civil aviation may be developed in a safe and orderly manner and that international air transport services may be established on the basis of equality of opportunity and operated soundly and economically;

Article 1 : Sovereignty

The contracting States recognise that every State has complete and exclusive sovereignty over the airspace above its territory.

Article 2 : Territory

For the purposes of this Convention the territory of a State shall be deemed to be the land areas and territorial waters adjacent thereto under the sovereignty, suzerainty, protection or mandate of such State.

Article 3 : Civil and state aircraft

(a) This Convention shall be applicable only to civil aircraft, and shall not be applicable to state aircraft.
(b) Aircraft used in military, customs and police services shall be deemed to be state aircraft.
(c) No state aircraft of a contracting State shall fly over the territory of another State or land thereon without authorisation by special agreement or otherwise and in accordance with the terms thereof
(d) The contracting States undertake, when issuing regulations for their state aircraft that they will have due regard for the safety of navigation of civil aircraft.

Article 3 bis *

(a) The contracting States recognise that every State must refrain from resorting to the use of weapons against civil aircraft in flight and that, in case of interception, the lives of persons on board and the safety of aircraft must not be endangered. This provision shall not be interpreted as modifying in any way the rights and obligations of States set forth in the Charter of the United Nations.

(b) The contracting States recognise that every State, in the exercise of its sovereignty is entitled to require the landing at some designated airport a civil aircraft flying above its territory without authority or if there are reasonable grounds to conclude that it is being used for any purpose ,consistent with the aims of this Convention, it may also give such aircraft any other instructions to put an end to such violations. For this purpose, the ·
contracting States may resort to any appropriate means Consistent with relevant rules of international law, including the relevant provisions of this Convention specifically paragraph (a) of this Article, Each contracting State agrees to publish its regulations in force regarding the interception of civil aircraft

(c) Every civil aircraft shall comply with an order given in conformity with paragraph (b) of this Article. To this end each contracting State shall establish all necessary provisions in its national laws or regulations to make such compliance mandatory for any civil aircraft registered in that State or operated by an operator who has his principal place of business or permanent residence in that State. Each contracting State shall make any violation of such applicable laws or regulations punishable by severe penalties and shall submit the case to its competent authorities in accordance with its laws or regulations.

(d) Each contracting State shall take appropriate measures to prohibit the deliberate use of any civil aircraft registered in that State or operated by an operator who has his principal place of business or permanent residence in that State for any purpose inconsistent with the aims of this Convention. This provision shall not affect paragraph (a) or derogate from paragraphs (b) ad (c) of this Article.

Scheduled air services

No scheduled international air service may be operated over or into the territory of a contracting State, except with the special permission or other authorisation of that State, and in accordance with the terms of such permission or authorisation.

* Adopted on 10 May 1984. This amendment will enter into force when ratified by 102 states

Article 7 : Cabotage

Each contracting State shall have the right to refuse permission to the aircraft of other contracting States to take on in its territory passengers, mail and cargo carried for remuneration or hire and destined for another point within its territory. Each contracting State undertakes not to enter into any arrangements which specifically grant any such privilege on an exclusive basis to any other State or an airline of any other State, and not to obtain any such exclusive privilege from any other State.

Article 9 : Prohibited Areas

a)   Each contracting State may, for reasons of military necessity or public safety, restrict or prohibit uniformly the aircraft of other States from flying over certain areas of its territory, provided that no distinction in this respect is made between the aircraft of the State whose territory is involved, engaged in international scheduled airline services; and the aircraft of the other contracting States likewise engaged. Such prohibited areas shall be of reasonable extent and location so as not to interfere unnecessarily with navigation. Descriptions of such prohibited areas in the territory of a contracting State, as well as any subsequent alterations therein, shall be communicated as soon as possible to the other Contracting States and to the International Civil Aviation Organisation.

b)   Each contracting State reserves also the right, in exceptional circumstances or during a period of emergency, or in the interest of public safety, and with immediate effect, temporarily to restrict or prohibit flying over the whole or any part of its territory, on condition that such restriction or prohibition shall be applicable without distinction of nationality to aircraft of all other States.

Article 37 : Adoption of international standards and procedures

Each contracting State undertakes to collaborate in securing the highest practicable degree of uniformity in regulations, standards, procedures, and organisation in relation to aircraft, personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and Improve air navigation.

Article 38 : Departures from international standards and procedures

Any State which finds it impracticable to comply in all respects with any such international standard or procedure, or to bring its own regulations or practices into full accord with any international standard or procedure after amendment of the latter, or which deems it necessary to adopt regulations or practices differing in any particular respect from those established by an international standard, shall give immediate notification to the International Civil Aviation Organisation of the differences between its own practice and that established by the international standard. In the case of amendments to international standards, any State which does not make the appropriate amendments to its own regulations or practices shall give notice to the Council within sixty days of the adoption of the amendment to the international standard, or indicate the action which it proposes to take. In any such case the Council shall make immediate notification to all other states of the difference which exists between one or more features of an international standard and the corresponding national practice of that State.

Article 44 : Objectives

The aims and objectives of the Organisation are to develop the principles and techniques of international air navigation and

to foster the planning and development of international air transport so as to:

(a) Insure the safe and orderly growth of international civil aviation throughout the world;

(b) Encourage the arts of aircraft design and operation for peaceful purposes;

(c) Encourage the development of airways, airports, and air navigation facilities for international civil aviation;

(d) Meet the needs of the peoples of the world for safe, regular, efficient and economical air transport;

(e) Prevent economic waste caused by unreasonable competition;

(f) Insure that the rights of contracting States are fully respected and that every contracting State has a fair opportunity to operate international

(g) Avoid discrimination between contracting States

(h) Promote safety of flight in international air navigation;

(i) Promote generally the development of all aspects of international civil aeronautics.

Article 54 : Mandatory functions of Council

The Council shall:

(a) Submit annual reports to the Assembly;

(b) Carry out the directions of the Assembly and discharge the duties and obligations which are laid on it by this Convention;

(c) Determine its organisation and rules of procedure,

(d) Appoint and define the duties of an Air Transport Committee, which shall be chosen from among the representatives of the members of the Council, and which shall be responsible to It;

(e) Establish an Air Navigation Commission, in accordance with the provisions of Chapter X;

(f) Administer the finances of the Organisation in accordance provisions of Chapters XII and XV

(g) Determine the emoluments of the President of the Council;

(h) Appoint a chief executive officer who shall he called the Secretary

General, and make provision for the appointment of such other personnel may be necessary, in accordance with the provisions of Chapter XI;

(i) Request, collect, examine and publish information relating to the advancement of air navigation and the operation of international! air services, including information about the costs of operation and particulars of subsidies paid to airlines from public funds;

(j) Report to contracting States any infraction of this Convention, as well as any failure to carry out recommendations or determinations;

(k) Report to the Assembly any infraction of this Convention where a contracting State has failed to take appropriate action within a reasonable me after notice of the infraction;

(l) Adopt, in accordance with the provisions of Chapter VI of this Convention, international standards and recommended practices; for convenience, designate them as Annexes to this Convention; and notify all contracting States of the action taken;

(m) Consider recommendations of the Air Navigation Commission for amendment of the Annexes and take action in accordance with the provisions of Chapter XX;

(n) Consider any matter relating to the Convention which any contracting State refers to it.

Article 62 : Suspension of voting power

The Assembly may suspend the voting power in the Assembly and in the Council of any contracting State that fails to discharge within a reasonable period its financial obligations to the Organisation.

CHAP XVI JOINT OPERATING ORGANISATIONS AND POOLED SERVICES

Article 77 : Joint operating permitted

Nothing in this Convention shall prevent two or more contracting States from constituting joint air transport operating organisations or international operating agencies and from pooling their air services on any routes or in any regions. but such organisations or agencies and such pooled services shall be subject to all the provisions of this Convention, including those relating to the registration of agreements with the Council. The Council shall determine in what manner the provisions of this Convention relating to nationality of aircraft shall apply to aircraft operated by international operating agencies.

Article 79 : Participation in operating organisations

A State may participate in joint operating organisations or in poling arrangements, either through its government or through an airline company or companies designated by its government. The companies may, at the sole discretion of the State concerned, be state-owned or partly state owned or privately owned.

CHAPTER XVIII DISPUTES AND DEFAULT

Article 84 : Settlement of disputes

If any disagreement between two or more contracting States relating to the interpretation or application of this Convention and its Annexes cannot he settled by negotiation, it shall, on the application of any State concerned in the disagreement. be decided by the Council. No member of the Council shall vote in the consideration by the Council of any dispute to which it is a party. Any contracting State may, subject to Article 85, appeal from the decision of the Council to an ad hoc arbitral tribunal agreed upon with the other parties to the dispute or to the Permanent Court of International Justice. Any such appeal shall be notified to the Council within sixty days of receipt of notification of the decision of the Council.

Arbitration procedure

If any contracting State party to a dispute in which the decision of the Council is under appeal has not accepted the Statute of the Permanent

CHAPTER XIX WAR

Article 89 : War and emergency conditions

In case of war, the provisions of this Convention shall not affect the freedom of action of any of the contracting States affected, whether as belligerents or as neutral. The same principle shall apply in the case of any contracting State which declares a state of national emergency and notifies the fact to the Council.

Article 93 : Admission of other States

States other than those provided for in Articles 91 and 92 (a) may, subject to approval by any general international organisation set up by the nations of the world to preserve peace, be admitted to participation in this Convention by means of a four-fifths vote of the Assembly and on such conditions as the Assembly may prescribe: provided that In each case the assent of any State invaded or attacked during the present war by the State seeking admission shall be necessary.

Article 93 bis

    (a) Notwithstanding the provisions of Articles 91, 92 and 93 above:

        (1) A State whose government the General Assembly of the United Nations has recommended be debarred from membership in international agencies established by or brought into relationship with the United Nations shall automatically cease to be a member of the International Civil Aviation Organisation;

        (2) A State which has been expelled from membership in the United Nations shall automatically cease to be a

member of the International Civil Aviation Organisation unless the General Assembly of the United Nations attaches to its act of expulsion a recommendation to the contrary.

(b) A State which ceases to be a member of the International Civil Aviation Organisation as a result of the provisions of paragraph (a) above may, after approval by the General Assembly of the United Nations. be re-admitted to the International Civil Aviation Organisation upon application and upon approval by a majority of the Council.

(c) Members of the Organisation Which are suspended from the exercise of the rights and privileges of membership in the United Nations shall upon the request of the latter, be suspended from the rights and privileges of membership in this Organisation.

Article 94 : Amendment of Convention

(a) Any proposed amendment to this Convention must be approved by a two-thirds vote of the Assembly and shall then come into force in respect of States which have ratified such amendment when ratified by the number of contracting States specified by the Assembly. The number so specified shall not be less than two-thirds of the total number of contracting States.

(b) If in its opinion the amendment is of such a nature as to justify this course, the Assembly in its resolution recommending adoption may provide that any State which has not ratified within a specified period after the amendment has come into force shall thereupon cease to be a member of the Organisation and a party to the Convention